

NOISE IMPACT ANALYSIS
TOWN CENTRE RESIDENTIAL PROJECT
CITY OF LAKE FOREST, CA

Prepared for:

Brookfield Residential
3090 Bristol Street, Suite 220
Costa Mesa, CA 92626

Prepared by:

Hans Giroux & Associates
1820 E. Garry Avenue #211
Santa Ana, CA 92705

RGP Planning & Development Services
8921 Research Drive
Irvine, CA 92618

Date:

July 24, 2012

Project No.: P12-012 N

PROJECT LOCATION & DESCRIPTION

The Town Centre Residential community is located in the Foothill Ranch community in the city of Lake Forest, at the southeast corner of Bake and Portola Parkways (Figure 1). The project site consists of 8.97 gross acres bounded by Bake and Portola Parkways to the west and north respectively, Auto Center Drive to the east, and The Village commercial center to the south. Commercial retail centers are also present to the west across Bake Parkway (Foothill Ranch Towne Centre). Across Auto Center Drive to the east is a Mercedes-Benz auto dealership, and light industrial/office uses are present north of Portola Parkway and along the south side of Towne Centre Drive.

The project will contain 151 single family attached homes within 11 two-story motorcourt-style buildings (see site plan in Figure 2 and typical motorcourt plan in Figure 3). Six floorplans are proposed, ranging from 763 to 1,747 square feet and with between 1 and 3 bedrooms. Overall project density is 16.8 dwelling units per gross acre. Each home would front on a common walkway and landscaped area. Walkways will connect each residence to all areas in the community, including a centrally-located, 8,500-square-foot recreation and gathering area and surrounding offsite sidewalks (Figure 4).

The project will include two gated entries, both off of Auto Center Drive. The entries will be connected to each other via a private drive. The private drive will offer access to a total of 355 on-site parking spaces. The community is planned to be walkable, allowing for easy connections to nearby retail, entertainment, service, office, and recreational uses.

NOISE SETTING

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Noise is generally considered to be unwanted sound. Sound is characterized by various parameters that describe the rate of oscillation of sound waves, the distance between successive troughs or crests, the speed of propagation, and the pressure level or energy content of a given sound. In particular, the sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level.

The decibel (dB) scale is used to quantify sound pressure levels. Although decibels are most commonly associated with sound, “dB” is a generic descriptor that is equal to ten times the logarithmic ratio of any physical parameter versus some reference quantity. For sound, the reference level is the faintest sound detectable by a young person with good auditory acuity.

Since the human ear is not equally sensitive to all sound frequencies within the entire auditory spectrum, human response is factored into sound descriptions by weighting sounds within the range of maximum human sensitivity more heavily in a process called “A-weighting,” written as dB(A). Any further reference in this discussion to decibels written as “dB” should be understood to be A-weighted.

**Figure 1
Project Location**

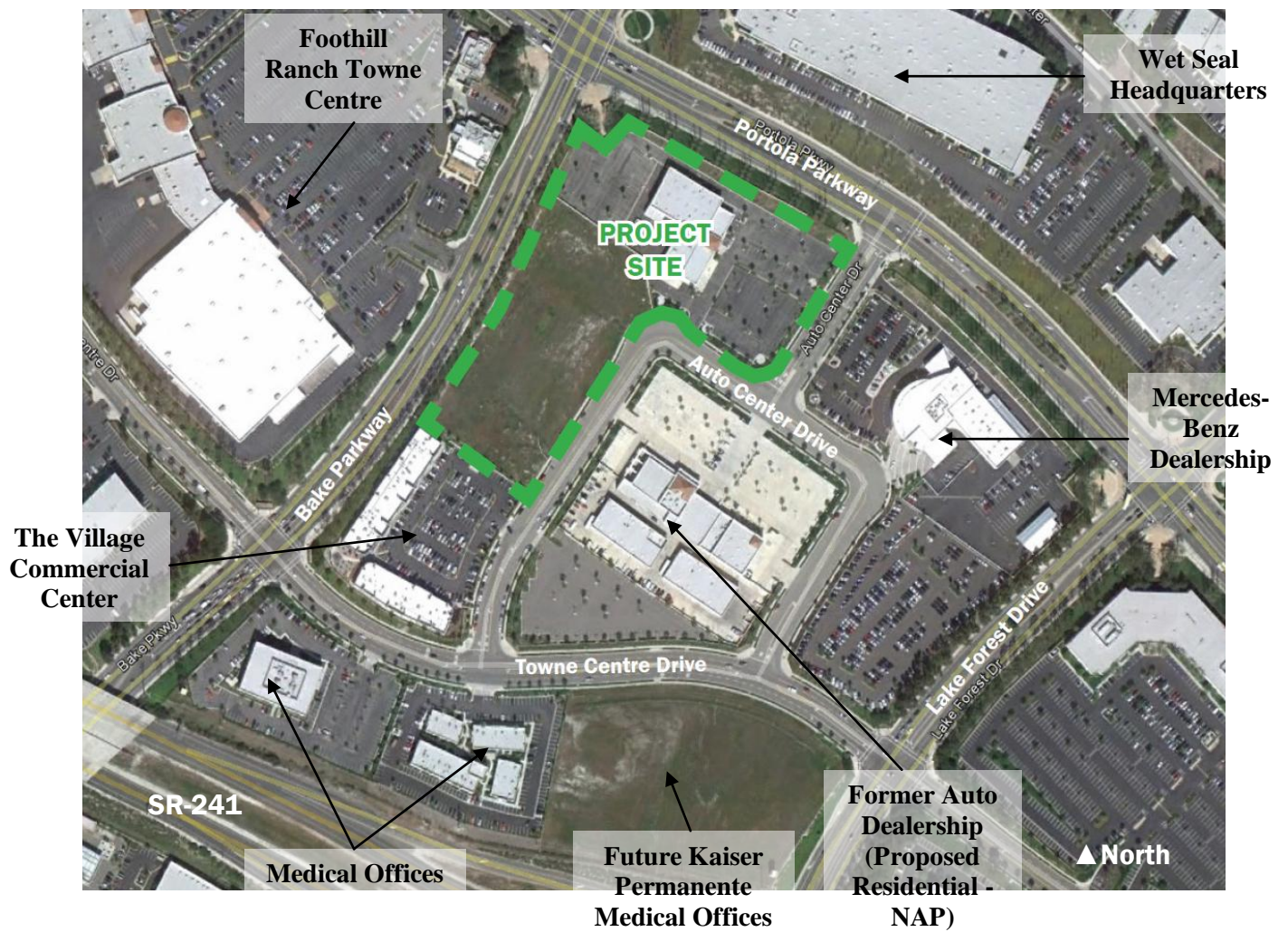
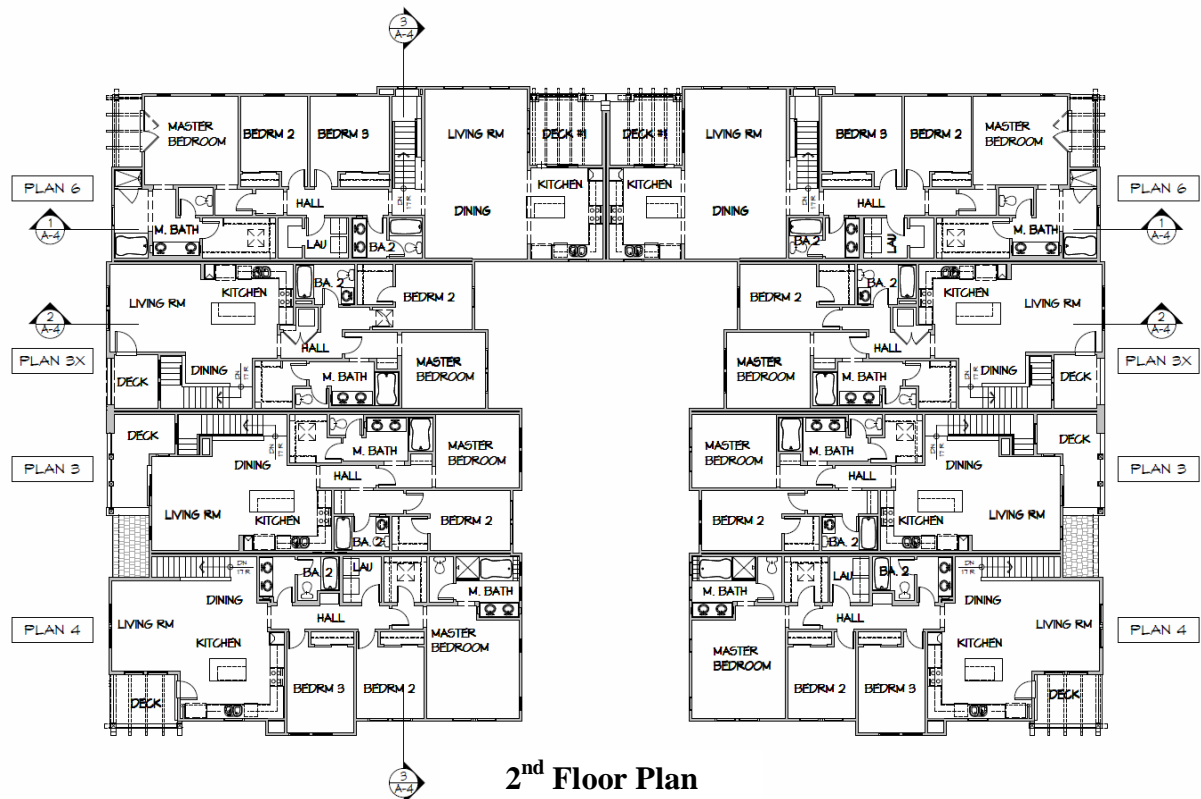
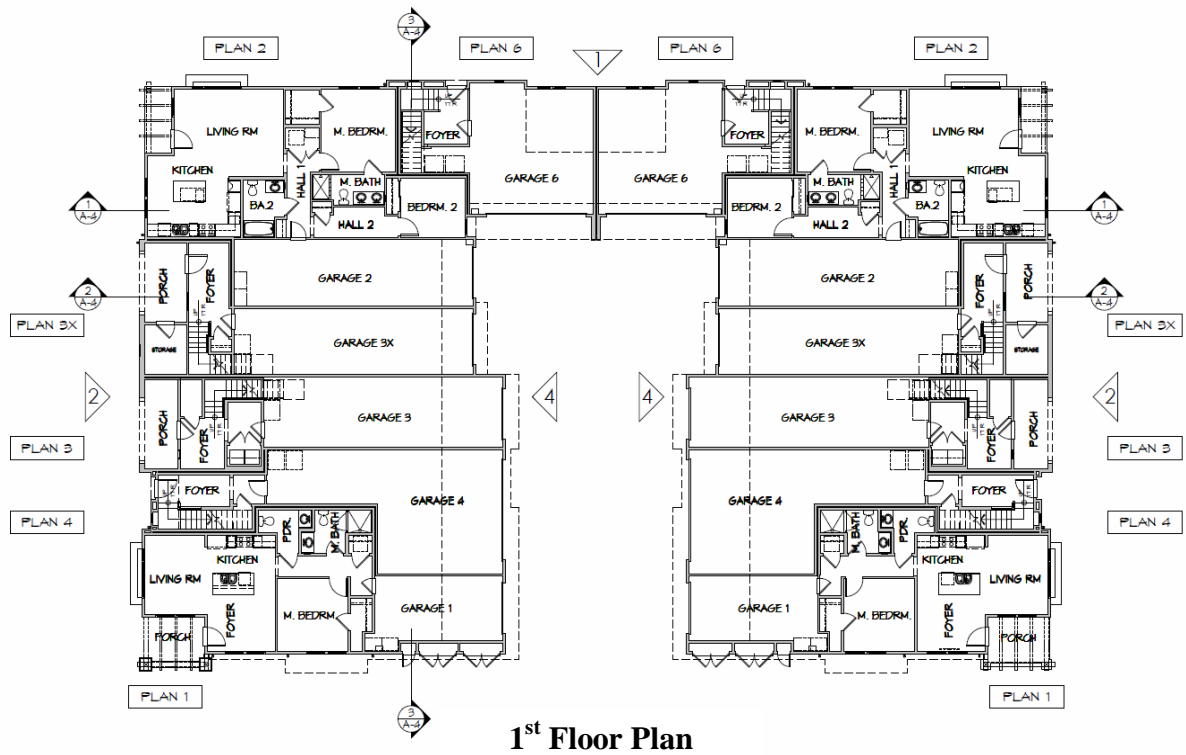


Figure 2
Site Plan



Figure 3 Typical Motorcourt Plan



**Figure 4
Recreation Center Detail**



Building Floorplan



**Recreation Area
Site Plan**

Time variations in noise exposure are typically expressed in terms of a steady-state energy level equal to the energy content of the time varying period (called LEQ), or alternately, as a statistical description of the sound pressure level that is exceeded over some fraction of a given observation period. Finally, because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, state law requires that, for planning purposes, an artificial dB increment be added to quiet time noise levels in a 24-hour noise descriptor called the Ldn (day-night) or the Community Noise Equivalent Level (CNEL). The CNEL metric has gradually replaced the Ldn factor, but the two descriptors are essentially identical.

CNEL-based standards are generally applied to transportation-related sources because local jurisdictions are pre-empted from exercising direct noise control over vehicles on public streets, aircraft, trains, etc. The City of Lake Forest therefore regulates the traffic noise exposure of the receiving property through land use controls.

Noise/land use compatibility standards for various classes of land uses are expressed in the Safety and Noise Element of the General Plan to insure that noise exposure is considered in any development decisions. The City of Lake Forest General Plan has guidelines for noise exposure standards which are shown in Table 1. For residential uses such as the Town Centre Residential project, the City recommends an exterior noise exposure of 65 dB CNEL and interior noise exposure of 45 dB CNEL.

For “stationary” noise sources such as mechanical equipment (pool pumps, air conditioners, etc.) the City does have legal authority to establish noise performance standards designed to not adversely impact adjoining residential uses. These standards are typically articulated in the jurisdictional Municipal Code. These standards recognize the varying noise sensitivity of both transmitting and receiving land uses. The property line noise performance standards are normally structured according to land use and time-of-day.

Table 1

City of Lake Forest Interior and Exterior Noise Standards (General Plan Safety and Noise Element)

Land Use	Noise Standards ¹	
	Interior ^{2,3}	Exterior
Residential - Single-family, multi-family, duplex, mobile home	CNEL 45 dB	CNEL 65 dB ⁴
Residential - Transient lodging hotels, motels, nursing homes, hospitals	CNEL 45 dB	CNEL 65 dB ⁴
Private offices, church sanctuaries, libraries, board rooms, conference rooms, theaters, auditoriums, concert halls, meeting halls, etc.	Leq(12) 45 dB(A) ⁽⁶⁾²	—
Schools	Leq(12) 45 dB(A)	CNEL 65dB ⁽⁵⁾
General offices, reception, clerical, etc.	Leq(12) 50 dB(A)	—
Bank lobby, retail store, restaurant, typing pool, etc.	Leq(12) 55 dB(A)	—
Manufacturing, kitchen, warehousing, etc.	Leq(12) 65dB(A)	—
Parks, playgrounds	—	CNEL 65 dB ⁽⁵⁾
Golf courses, outdoor spectator sports, amusement parks	—	CNEL 70 dB ⁽⁵⁾
<p>Notes:</p> <p>1 CNEL - Community Noise Equivalent Level Leq(12) - The A-weighted equivalent sound level averaged over a 12-hour period (usually the hours of operation).</p> <p>2 Noise standard with windows closed. Mechanical ventilation shall be provided per UBC requirements to provide a habitable environment.</p> <p>3 Indoor environment excluding bathrooms, toilets, closets, and corridors.</p> <p>4 Outdoor environment limited to rear yard of single-family homes, multi-family patios and balconies (with a depth of 6' or more) and common recreation areas.</p> <p>5 Outdoor environment limited to playground areas, picnic areas, and other areas of frequent human use.</p> <p>6 Religious institutions (Churches, temples, and other places of worship) of a small size (occupancy of 100 persons or less) may occupy existing buildings within areas of exterior noise levels ranging from 65 to 75 dB CNEL without providing additional noise insulation for the building.</p> <p>Source: City of Lake Forest General Plan, July 11, 1995.</p>		

CITY OF LAKE FOREST NOISE STANDARDS

The City Noise Ordinance (Chapter 11.16 of the City's Municipal Code), is designed to protect people from non-transportation (stationary) noise. The Noise Ordinance for the City of Lake Forest sets limits on the level and the duration of time a stationary noise source may impact an adjoining residential use.

Ordinance limits generally apply to "stationary" sources such as mechanical equipment, or vehicles operating on private property. The City's noise ordinance limits are stated in terms of a 30-minute limit with allowable deviations from this 50th percentile standard. The louder the level becomes, the shorter the time becomes that it is allowed to occur. Table 2 lists the noise level and the maximum cumulative period of time that the noise level may occur during a 1-hour period.

The Noise Ordinance identifies specific activities that would be exempt from the provisions of the noise restrictions. Exempted activities include, but are not limited to, construction, repair, remodeling and grading, provided such activities do not take place between the hours of 8:00 p.m. and 7:00 a.m. on weekdays, including Saturday, or at any time on Sunday or a federal holiday.

The noise standards in the City's Noise Ordinance sections 11.16.040 and 11.16.050 are provided in Table 2 and apply to all residential properties. Previous commercial use of the project site did not impose any noise constraints upon adjacent commercial Town Centre uses (car dealerships, restaurant services, retail, etc.). With the introduction of residences on the project parcel, the noise standards are applicable; however, as subsequently discussed, the Noise Ordinance standards will be met without placing restrictions on existing commercial uses.

Table 2

Lake Forest Noise Ordinance Standards

Noise Level ^a		Maximum Cumulative Duration
DAYTIME ORDINANCE (7 a.m. - 10 p.m.)		
Exterior Noise	Interior Noise	
75 dBA	65 dBA	Not to be exceeded at any time
70 dBA	60 dBA	1 minute
65 dBA	55 dBA	5 minutes
60 dBA	—	15 minutes
55 dBA	—	30 minutes
NIGHTTIME ORDINANCE (10 p.m. - 7 a.m.)		
70 dBA	55 dBA	Not to be exceeded at any time
65 dBA	50 dBA	1 minute
60 dBA	45 dBA	5 minutes
55 dBA	—	15 minutes
50 dBA	—	30 minutes
<p>Source: City of Lake Forest Municipal Code, Section 11.16, Noise Control.</p> <p>a. In the event the alleged offensive noise consists entirely of impact noise, simple tone noise, speech, music, or any combination thereof, each of the noise levels shall be reduced by 5 dBA.</p>		

BASELINE NOISE LEVELS

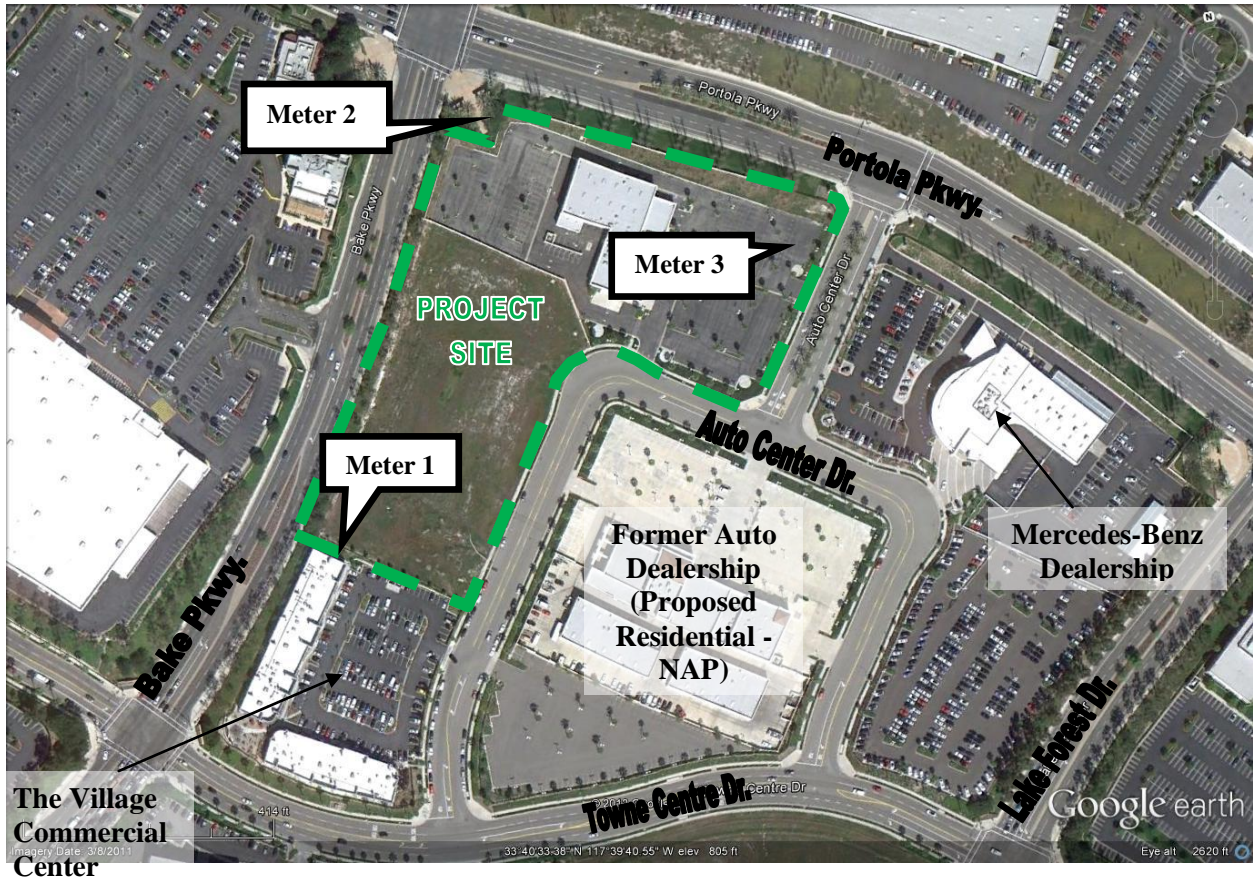
Noise measurements were made in order to document existing baseline levels in the area. These help to serve as a basis to determine noise exposure from ambient noise activities upon the proposed project. Long term (24-hour) noise measurements were conducted on Wednesday, March 14, to Thursday, March 15, 2012, at one on-site location and on Tuesday, March 20, through Wednesday, March 21, 2012 at two additional locations.

Long-term noise measurement locations were selected to document the daily trend in noise levels generated by area roadways, the strip mall in the southwest corner of the site (along Bake Parkway) and noise adjacent to the existing Mercedes Dealership (along Auto Center Drive). Measurement locations are shown in Figure 5. The monitoring results are shown in Table 3.

These meters yielded CNEL noise levels of 59 dB along The Village commercial strip mall perimeter and a CNEL of almost 58 dB along the site perimeter near the Mercedes Dealership. These noise levels are well within the City's residential noise standards of 65 dB CNEL. At the corner of Bake and Portola Parkway, noise readings were approximately 69 dB CNEL for a 90-foot setback from the Portola Parkway Centerline and 120 feet from the Bake Parkway centerline.

Project perimeter noise levels near 70 dB CNEL will require 25 dB of structural attenuation to reduce the exterior façade level to an acceptable indoor level of 45 dB CNEL. In modern residential construction, observed attenuation is 30 dB with closed dual-paned windows and supplemental ventilation. With anticipated traffic growth, future noise levels will only increase by 1-2 dB at most. Standard construction practice will therefore allow interior standards to be met with a reasonable margin of safety.

Figure 5
Noise Monitor Locations



Meter Location

Meter 1: Southwest corner of site, just north of existing strip mall

Meter 2: Northwest corner of project site at intersection of Bake and Portola

Meter 3: East side, just west of existing Mercedes Dealership along Auto Center Drive

Table 3 Noise Measurements

Existing Hourly Leq's (dB)

Time Interval	Leqs Meter 1	Leqs Meter 2	Leqs Meter 3
15:00-16:00	56.2	65.5	53.7
16:00-17:00	55.4	66.8	54.1
17:00-18:00	54.4	67.8	54.2
18:00-19:00	53.8	66.7	53.5
19:00-20:00	53.2	65.5	53.0
20:00-21:00	54.5	65.0	52.9
21:00-22:00	51.4	63.2	49.9
22:00-23:00	48.8	63.5	47.7
23:00-24:00	44.8	61.9	46.9
0:00-1:00	44.3	56.8	43.1
1:00-2:00	42.9	58.3	44.7
2:00-3:00	41.9	52.8	42.3
3:00-4:00	42.4	58.2	44.1
4:00-5:00	46.8	62.7	50.6
5:00-6:00	53.9	63.3	53.6
6:00-7:00	54.0	64.9	55.7
7:00-8:00	63.2	67.0	55.7
8:00-9:00	62.7	66.1	55.0
9:00-10:00	61.0	64.4	53.8
10:00-11:00	56.6	64.3	54.2
11:00-12:00	56.5	66.8	56.5
12:00-13:00	59.8	66.9	56.0
13:00-14:00	57.8	66.8	54.4
14:00-15:00	54.9	65.7	54.6

Resultant CNEL (dB)

Measurement Parameter	Meter 1	Meter 2	Meter 3
24-Hour CNEL	58.9	69.4	57.8

NOISE IMPACTS

NOISE SIGNIFICANCE CRITERIA

Noise impacts are considered significant if they result in:

- a. Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- b. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
- c. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
- d. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

STANDARDS OF SIGNIFICANCE

Noise impacts are considered significant if they expose persons to levels in excess of standards established in local general plans or noise ordinances. The exterior noise standard for the City of Lake Forest for residential uses is 65 dBA CNEL in usable outdoor space such as backyards, decks, patios, etc. If required, attenuation through setback and project perimeter barriers is anticipated to be used to reduce traffic noise to the 65 dBA CNEL goal. However, an inability to achieve this goal through the application of reasonably available mitigation measures would be considered a significant impact.

Impacts may also be significant if they create either a substantial permanent or temporary increase. The term “substantial” is not quantified in CEQA guidelines. In most environmental analyses, “substantial” is taken to mean a level that is clearly perceptible to humans. In practice, this is at least a +3 dB increase. Some agencies, such as Caltrans, require substantial increases to be +10 dB or more if noise standards are not exceeded by the increase. For purposes of this analysis, a +3 dB increase is considered a substantial increase. The following noise impacts due to project-related traffic would be considered significant:

1. If construction activities were to audibly intrude into adjacent residential areas during periods of heightened noise sensitivity.
2. If project traffic noise were to cause an increase by a perceptible amount (+3 dB CNEL) on any roadway segment adjacent to a noise sensitive land use.
3. If future, with-project noise levels were to expose receivers to levels exceeding City of Lake Forest General Plan Safety & Noise Element noise standards shown in Table 1.

4. If future, with-project noise levels were to expose receivers to levels exceeding City of Lake Forest Zoning Ordinance noise standards shown in Table 2.

CONSTRUCTION NOISE IMPACTS

Temporary construction noise impacts will vary markedly because the noise strength of construction equipment ranges widely as a function of the equipment used and its activity level. Short-term construction noise impacts tend to occur in discrete phases dominated initially by demolition of existing structures and large earth-moving sources, then by foundation and parking lot construction, and finally for finish construction. The demolition and earth-moving sources are the noisiest, with equipment noise typically ranging from 75 to 90 dB at 50 feet from the source.

Figure 6 shows the range of noise emissions for various pieces of construction equipment. Point sources of noise emissions are attenuated by a factor of 6 dB per doubling of distance through geometrical (spherical) spreading of sound waves. The quieter noise sources will drop to 65 dB exterior/ 45 dB interior noise levels by about 200 feet from the source while the loudest may require over 1,000 feet from the source to reduce the 90+ dB source strength to a generally acceptable 65 dB exterior exposure level. This estimate assumes a clear line-of-sight from the source to the receiver. Variations in terrain elevation or existing structures will act as noise barriers that may interrupt equipment noise propagation. Construction noise impacts are, therefore, somewhat less than that predicted under idealized input conditions.

There are currently no noise-sensitive receivers within 1,000 feet of planned construction activities. There are, however, residential uses proposed for the vacant auto dealership east and southeast of the proposed Brookfield development. Depending upon the progress of either project, there could be nearby noise-sensitive land uses. FHWA has developed a construction activity noise model that is an industry standard for assessing construction activity noise impacts.

Quantitatively, the primary noise prediction equation is expressed as follows for the hourly average noise level (L_{eq}) at distance D between the source and receiver (dB):

$$L_{eq} = L_{max} @ 50' - 20 \log (D/50') + 10 \log (U.F\%/100) - I.L.(bar)$$

Where:

$L_{max} @ 50'$ is the published reference noise level at 50 feet

U.F.% is the usage factor for full power operation per hour

I.L.(bar) is the insertion loss for intervening barriers

Published reference noise levels for heavy construction equipment used in clearing, excavation and grading include the following:

Dozers	85 dB
Tractors	80 dB
Backhoes	86 dB
Excavators	86 dB

Graders 86 dB
Source: Noise Control for Buildings..., BBN, 1987

Assuming three large pieces of equipment operate in close proximity, their combined L_{max} reference level is 91 dB at 50 feet. Under a clear line of sight and a typical usage factor of 40 percent, the hourly noise level as a function of distance is as follows:

Distance to Source	Hourly Level
100 feet	81 dB
200 feet	75 dB
320 feet	71 dB
400 feet	69 dB
500 feet	67 dB
640 feet	65 dB
800 feet	63 dB
1000 feet	61 dB

Levels of 65 dB can interfere with comfortable conversation and levels of 75 dB can intrude into quiet interior activities such as reading or children napping even with closed windows. Except in limited locations, noise levels in any already completed residential developments will not exceed 75 dB Leq during construction. Outdoor levels of 65 dB may extent farther into adjacent noise-sensitive uses, but completed structures and perimeter walls will reduce the construction noise footprint. City policy is therefore to restrict construction activities involving heavy equipment to hours of lesser residential sensitivity if occupied residences are nearby.

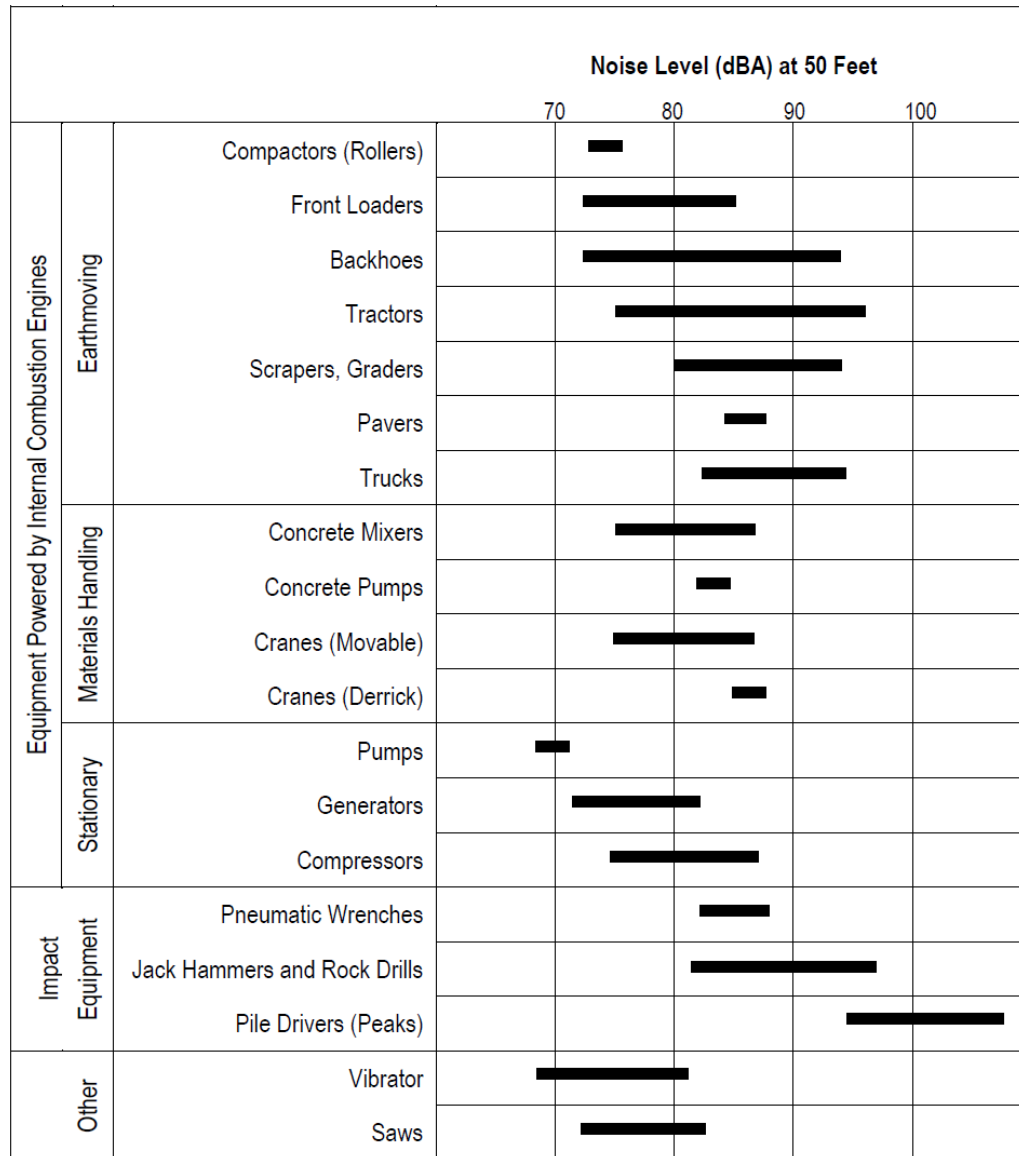
According to the City of Lake Forest Municipal Code, permissible hours of construction are 7 a.m. to 8 p.m. on weekdays and on Saturdays. Construction is not permitted on any national holiday or on any Sunday. These hours are included as conditions on any project construction permits and these limits will serve to minimize any adverse construction noise impact potential.

Although construction noise impacts are less-than-significant, and mitigation measures are not required, the following construction practices are recommended to further reduce construction noise levels:

- All mobile equipment should have properly operating and maintained mufflers.
- Haul routes should avoid residential development, where feasible.

Figure 6

Typical Construction Equipment Noise Generation Levels



Source: EPA PB 206717, Environmental Protection Agency, December 31, 1971, "Noise from Construction Equipment and Operations."

CONSTRUCTION ACTIVITY VIBRATION

Typical background vibration levels in residential areas are usually 50 VdB or lower, below the threshold of human perception. Perceptible vibration levels inside residences are typically attributed to the operation of heating and air conditioning systems, door slams or street traffic. Construction activities and street traffic are some of the most common external sources of vibration that can be perceptible inside residences.

Construction activities generate ground-borne vibration when heavy equipment travels over unpaved surfaces or when it is engaged in soil movement. The effects of ground-borne vibration include discernable movement of building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. Vibration related problems generally occur due to resonances in the structural components of a building because structures amplify groundborne vibration. Within the “soft” sedimentary surfaces of much of Southern California, ground vibration is quickly damped out. Groundborne vibration is almost never annoying to people who are outdoors (FTA 2006).

Groundborne vibrations from construction activities rarely reach levels that can damage structures. Because vibration is typically not an issue, very few jurisdictions have adopted vibration significance thresholds. Vibration thresholds have been adopted for major public works construction projects, but these relate mostly to structural protection (cracking foundations or stucco) rather than to human annoyance.

Vibration is most commonly expressed in terms of the root mean square (RMS) velocity of a vibrating object. RMS velocities are expressed in units of vibration decibels. The range of vibration decibels (VdB) is as follows:

65 VdB	-	threshold of human perception
72 VdB	-	annoyance due to frequent events
80 VdB	-	annoyance due to infrequent events
94-98 VdB	-	minor cosmetic damage

To determine potential impacts of the project’s construction activities, estimates of vibration levels induced by the construction equipment at various distances are presented in Table 4.

Table 4
Approximate Vibration Levels Induced by Construction Equipment

Equipment	Approximate Vibration Levels (VdB)*			
	25 feet	50 feet	100 feet	1000 feet
Pile Driver	93	87	81	61
Large Bulldozer	87	81	75	55
Loaded Truck	86	80	74	54
Jackhammer	79	73	67	47
Small Bulldozer	58	52	46	26

* (FTA Transit Noise & Vibration Assessment, Chapter 12, Construction, 2006)

With the exception of pile driving which is not anticipated for use on this project, the on-site construction equipment that will create the maximum potential vibration is a large bulldozer. The stated vibration source level in the FTA Handbook for such equipment is 81 VdB at 50 feet from the source. By 1,000 feet the vibration level dissipates to 55 VdB which is below the threshold of human perception. The nearest residential receptor is approximately 1,500 feet from the project site and will not experience any perceptible vibration impacts. Construction activity vibration impacts are judged as less-than-significant.

PROJECT-RELATED VEHICULAR NOISE IMPACTS

Long-term noise concerns from the development of residential uses at the project site center primarily on mobile source emissions on project area roadways. These concerns were addressed using the California specific vehicle noise curves (CALVENO) in the federal roadway noise model (the FHWA Highway Traffic Noise Prediction Model, FHWA-RD-77-108). The model calculates the Leq noise level for a particular reference set of input conditions, and then makes a series of adjustments for site-specific traffic volumes, distances, roadway speeds, or noise barriers. The typical Orange County day-night travel percentages and auto-truck vehicle mixes is then applied to convert one-hour Leq levels to a weighted 24-hour CNEL.

Table 5 summarizes the calculated 24-hour CNEL level at 50 feet from the roadway centerline along project adjacent roadway segments. Three time frames were evaluated; existing conditions with and without project, year 2015 with and without project, and 2030 with and without project. The noise analysis utilized data from the project traffic analysis, prepared in March of 2012, by Stantec Consulting Services, Inc, for this project.

The project itself will not cause any roadway segment to exceed the +3 dB CNEL threshold. The largest project related noise increase is +0.5 dB CNEL at 50 feet from the roadway centerline. This segment is along Towne Centre Drive between Bake Parkway and Auto Center Drive, adjacent to the project site entrance.

Cumulative impacts compare the “future with project” noise levels with “existing no project” scenario. The majority of the cumulative increases are attributed to area growth that will occur with or without project implementation. The largest cumulative traffic noise increase is +1.1 dB CNEL again at Towne Centre Drive between Bake Parkway and Auto Center Drive, which is less than the +3 dB CNEL threshold. Therefore, both project only traffic noise impacts and cumulative traffic noise impacts are considered to be less-than-significant. In areas of peak traffic noise along Bake Parkway, the planned Alton Parkway extension will divert a portion of Bake Parkway traffic, which will result in lower increases of noise levels. Because the future noise level increases without the Alton Parkway extension are already less than the +3 dB CNEL threshold, both project-only traffic noise impacts and cumulative traffic noise impacts are considered to be less-than-significant.

Table 5

**Near Term Traffic Noise Impact Analysis
(CNEL in dB at 50 feet from Centerline)**

<i>Road Segment</i>	<i>Existing</i>	<i>Existing + Project</i>	<i>2015</i>	<i>2015 + Project</i>	<i>2030</i>	<i>2030 + Project</i>
Towne Centre Dr/ Bake-Auto Center Dr.	66.3	66.3	66.9	67.4	66.9	67.4
Towne Centre Dr/ Auto Center Dr-Lake Forest Dr	66.3	66.3	66.3	66.3	66.3	66.3
Towne Centre Dr/ Center Dr-Lake Forest	66.3	66.3	66.9	66.9	66.9	66.9
Bake Pkwy/ 241-Towne Centre	73.3	73.3	71.8	71.8	72.2	72.2
Bake Pkwy/ Towne Centre-Portola	71.8	71.8	70.6	70.6	70.9	70.9
Portola Pkwy/ Bake-Auto Center Dr.	71.6	71.8	72.0	72.0	72.5	72.5
Portola Pkwy/ Auto Center Dr-Lake Forest Dr	72.0	71.8	72.2	72.2	72.5	72.5
Lake Forest Dr/ Rancho Prwy-241	71.3	71.3	70.6	70.6	71.5	71.5
Lake Forest Dr/ 241-Towne Centre	70.6	70.6	69.9	69.9	70.6	70.6
Lake Forest Dr/ Towne Centre-Portola	69.3	69.3	69.0	69.0	69.6	69.6

**Project Related Noise Impact
(CNEL in dB at 50 feet from Centerline)**

<i>Road Segment</i>	<i>Project Only Impact Existing</i>	<i>Project Only 2015</i>	<i>Project Only 2030</i>	<i>Cumulative Impact</i>
Towne Centre Dr/ Bake-Auto Center Dr.	0.0	0.5	0.5	1.1
Towne Centre Dr/ Auto Center Dr-Lake Forest Dr	0.0	0.0	0.0	0.0
Towne Centre Dr/ Center Dr-Lake Forest	0.0	0.0	0.0	0.6
Bake Pkwy/ 241-Towne Centre	0.0	0.0	0.0	-1.1*
Bake Pkwy/ Towne Centre-Portola	0.0	0.0	0.0	-1.0*
Portola Pkwy/ Bake-Auto Center Dr.	0.2	0.0	0.0	0.8
Portola Pkwy/ Auto Center Dr-Lake Forest Dr	-0.2	0.0	0.0	0.5
Lake Forest Dr/ Rancho Prwy-241	0.0	0.0	0.0	0.2
Lake Forest Dr/ 241-Towne Centre	0.0	0.0	0.0	0.0
Lake Forest Dr/ Towne Centre-Portola	0.0	0.0	0.0	0.3

*Alton Parkway extension, which adds parallel capacity, will relieve Bake Parkway congestion. The extension opened in July 2012.

ON-SITE NOISE EXPOSURE

Exterior Noise Levels

Table 6 lists the existing and predicted future traffic noise levels along Bake and Portola Parkways, 50 feet from the roadway centerline. Residential recreational area traffic noise exposures are calculated at areas of probable use (patio, balcony, etc.). Receiver building locations for the Town Centre Residential project closest to major roadways selected for analysis are (see Figure 7 for building numbers):

- 1 Plan 1 deck, in Building 4
- 2 Plan 3 decks, in Buildings 1 and 4
- 3 Plan 3x decks, in Buildings 1, 3, and 4
- 1 Plan 4 deck, in Building 1
- 1 Plan 5 deck, in Building 3
- 14 Plan 6 decks facing Bake Parkway (8 units) and Portola Parkway (6 units), in Buildings 1 – 7.

As shown in the subsequent discussion, only the Plan 6 decks would potentially require mitigation. The buildings containing units potentially requiring mitigation are indicated in Figure 7. The specific outdoor spaces that may require mitigation are labeled “Deck #1” and highlighted in Figure 8.

Table 6
Buildings 1 - 7 Second-Story Plan 6 Decks
Expectant Noise Levels at Build-Out

	Existing Noise Level at 50 feet to Centerline	Future Noise Level at 50 feet to Centerline	Future Façade Noise Loading
Portola Parkway	71.6 dB	72.5 dB	69.1 dB
Bake Parkway	71.8 dB	70.9 dB	68.9 dB
<i>General Plan Noise Standard: 65 dB</i>			

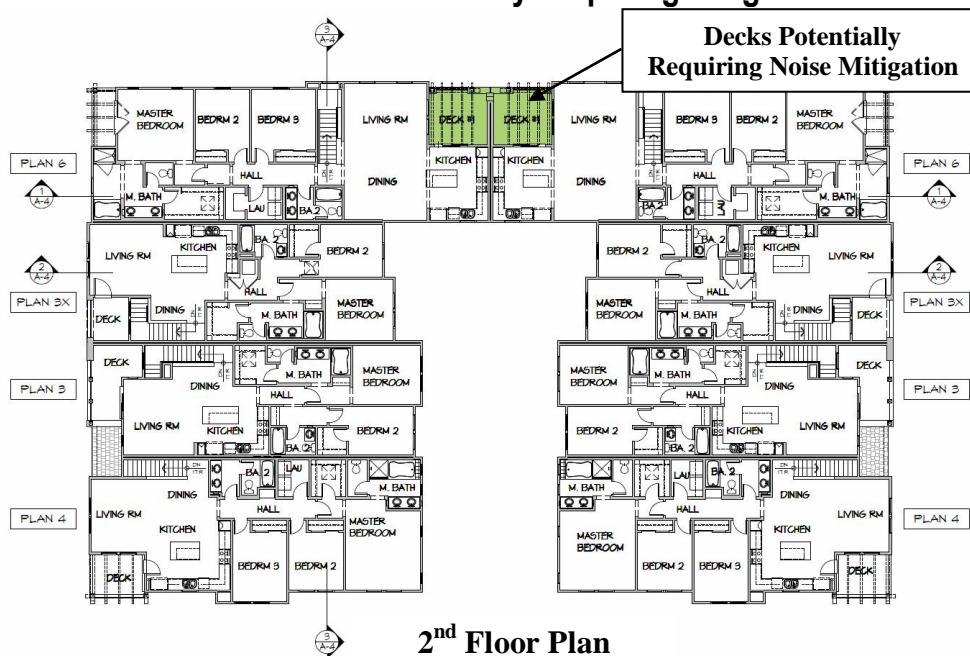
Noise levels at the building façade and are not necessarily representative of what a receiver might observe on an exterior deck or balcony. The Plan 6 decks facing Portola or Bake Parkways will be structurally shielded on three sides. A receiver sitting at an outdoor patio table or on a lounge chair will only have a partial view of passing vehicles and associated noise. On average, shielding effects would produce a -3 dB reduction from the direct line-of-sight condition. Future noise levels on Plan 6 main decks in Buildings 1-7 would be 66 dB CNEL. Such levels would very marginally exceed the City of Lake Forest exterior noise standard of 65 dB CNEL.

If the decks on these units are required to meet established noise thresholds, noise protection may be required. A transparent noise shield (e.g., plexi-glass) for this unit along the deck portion facing Portola or Bake would reduce noise by at least 5 dB and provide compatibility compliance.

Figure 7
Buildings with Units Potentially Requiring Noise Mitigation



Figure 8
Deck Locations Potentially Requiring Mitigation



Because a shield must break the line-of-sight between the receiver and noise source, there is no simple mitigation measure to only reduce noise levels by the needed 1 dB. A 5.5 foot plexi-glass wall will reduce noise levels more than 1dB, which would result in noise levels well below 65 dB CNEL.

However, recreational uses at the Town Centre Residential project may be considered to be common outdoor space sited in the interior of the complex. The ground level pool and recreational area can be considered common use space. This area is noise protected by the perimeter residential units such that noise levels are expected to be well within the 65 dB CNEL limit. Most jurisdictions do not require noise protection for individual recreational space if noise-protected common space is provided, which is the case with this project.

The buildings on the corner of Bake and Portola Parkways (Buildings 3 and 4 in Figure 7) have ground floor units with patios which have a view of these roadways. These patios exceed 6 feet in depth and are therefore subject to the Safety and Noise Element threshold for outdoor habitable space. These patios are set back from both roadways by 200 feet; noise will be below 65 dB CNEL due to the distance separation. These buildings also have second-story patios which have a potential view of both roadways. The Building 3 units front Bake Parkway and the Building 4 units front Portola Parkway. However, these decks are set back from the roadways they front by 200 feet. Additionally, Building 3 partially shields Building 4 street noise, and vice versa. This directional shielding would provide approximately -3 dB or noise attenuation. The potentially impacted decks on Buildings 3 and 4 are recessed and are therefore afforded -2 dB of noise attenuation for the resultant noise levels described in Tables 7 and 8:

Table 7
Building 3 Second-Story Decks
Expectant Noise Levels at Build-Out

Unit Evaluated	Distance from Roadway	Decayed Traffic Noise level at Unit*	Attenuation from Building 4 Shielding	Attenuation for Recessed Location	Residual Noise Level
Plan 3x	200 feet	64.2 dB	-3 dB	-2 dB	59.2 dB
Plan 5	200 feet	64.2 dB	-3 dB	-2 dB	59.2 dB
*with no shielding General Plan Noise Standard: 65 dB					

Table 8
Building 4 Second-Story Decks
Expectant Noise Levels at Build-Out

Unit Evaluated	Distance from Roadway	Decayed Traffic Noise level at Unit*	Attenuation from Building 3 Shielding	Attenuation for Recessed Location	Residual Noise Level
Plan 3	200 feet	66.5 dB	-3 dB	-2 dB	61.5 dB
Plan 3x	200 feet	66.5 dB	-3 dB	-2 dB	61.5 dB

Unit Evaluated	Distance from Roadway	Decayed Traffic Noise level at Unit*	Attenuation from Building 3 Shielding	Attenuation for Recessed Location	Residual Noise Level
Plan 4	200 feet	66.5 dB	-3 dB	-2 dB	61.5 dB
*with no shielding General Plan Noise Standard: 65 dB					

Buildings along Auto Center Drive (including all second-story decks in Building 1) are projected to experience noise levels of less than 65 dB CNEL. The “future with project” scenario shows an estimated 1,000 vehicles per day on this roadway, which would translate to less than 58 dB CNEL at 50 feet from roadway centerline at a traffic speed of 45 mph.

Plan 2 and Plan 6 units each have smaller decks outside their master bedrooms at the end/corner of each unit. The depth of these decks is less than 6 feet and therefore does not meet the Safety and Noise Element threshold where noise impact/mitigation on outdoor habitable space must be evaluated.

Interior Noise Levels

For the units exposed to the greatest noise levels in the complex (units fronting Bake and Portola Parkways), the noise level has been shown to be a maximum of 69 dB CNEL immediately outside the units (in their patio areas, as shown in Table 6). Exterior-to-interior attenuation of 24 dB would therefore be required to meet the interior noise standard of 45 dB CNEL in habitable rooms with Portola Parkway and Bake Parkway frontage. For typical wood-frame construction with stucco and gypsum board wall assemblies, the noise level reduction is as follows:

Partly open windows – 12 dB
Closed single-paned windows – 20 dB
Closed dual-paned windows – 30 dB

Use of dual-paned windows is required by the California Building Code for energy conservation in new residential construction. Interior noise standards would therefore be met with a large margin of safety, with noise levels of only 39 dB CNEL when windows are closed at the noisiest units. It is noted that where window closure is a requirement for interior noise control, the Building Code requires provision of supplemental ventilation at a specified rate with a specified fraction of fresh make-up air. The provision of supplemental ventilation is a standard construction practice.

The Building Code also requires that horizontal sound transmission be controlled between adjacent units, and the vertical noise and footfall impact be mitigated within stacked units. “Party walls” and floor-ceiling assemblies must be constructed to achieve a sound transmission class (STC) of 50. The impact isolation class (IIC) must be 50 or higher for floor-ceiling transmission. If standard structural assemblies are used, their sound and impact characteristics have been tested, and test report results are shown on building plans at plan check. Non-standard assemblies must be field-tested before any certificate of occupancy can be issued. The provision of walls and floors with minimum STCs and IICs, respectively, is a standard construction

practice. If required by the City, documentation of intra-unit sound isolation will be included in a final acoustical report produced as part of the building plan check process.

ON-SITE NOISE IMPACTS FROM MERCEDES DEALERSHIP

As shown in Table 3 (above), the CNEL along the project boundary with the existing Mercedes Dealership is less than 58 dB and the hourly Leqs are not greater than 56 dB. However, the noise standards presented in Table 2 (above) contain an Lmax threshold as well as for 5, 15 and 30 minutes. Therefore, these parameters were evaluated as well as shown in Table 9, below:

Table 9
On-Site Noise Impacts from Mercedes Dealership

Time Interval	Lmax	5 minute max	15 minute max	30 minute max
15:00-16:00	66	55	53	53
16:00-17:00	68	56	54	53
17:00-18:00	65	56	54	53
18:00-19:00	62	55	54	53
19:00-20:00	65	55	53	52
20:00-21:00	65	55	53	52
21:00-22:00	63	54	46	45
22:00-23:00	67	46	45	44
23:00-24:00	67	46	43	42
0:00-1:00	55	45	43	42
1:00-2:00	62	46	43	42
2:00-3:00	59	43	41	41
3:00-4:00	64	45	42	41
4:00-5:00	65	54	52	46
5:00-6:00	61	56	54	53
6:00-7:00	64	58	56	55
7:00-8:00	69	58	56	55
8:00-9:00	65	57	55	54
9:00-10:00	65	56	54	53
10:00-11:00	62	56	54	53
11:00-12:00	71	57	54	53
12:00-13:00	70	56	54	53
13:00-14:00	69	56	55	54
14:00-15:00	69	55	53	53
Not To Exceed Daytime Standard	75	65	60	55
Not To Exceed Nocturnal Standard	70	60	55	50

Note: Shaded boxes indicate hours subject to nocturnal noise standards.

The nocturnal noise ordinance standard is exceeded from 6-7 a.m. for the 15-minute threshold and from 5-7 a.m. for the 30-minute criterion. These levels are due to ambient traffic and not the dealership. All noise levels are below the daytime standard during hours of dealership operations

even with the inclusion of background traffic noise. Placement of residences on the site will not create a noise constraint upon dealership sales or maintenance activities.

Similarly, measured existing noise levels at the interface between the project site and the various commercial uses south of the site are well within noise ordinance standards. Project implementation will not impose any noise limitations upon existing commercial standards with a considerable margin of safety.

ON-SITE NOISE IMPACTS FROM THE VILLAGE COMMERCIAL CENTER

The proposed site plan will place residential units adjacent to the Village Center. That will create a commercial/residential interface with a possible noise constraint that did not exist at the commercial/commercial property line. The current commercial uses closest to proposed Buildings 7 and 8 are relatively benign in terms of noise generation. The current uses closest to these proposed buildings are (in order south from Building 7) a sushi bar (currently vacant), a nail salon, a Thai restaurant (Table 1), a sub shop (Jersey Mike's), dental center (Towne Center Group), acupuncturist (Dantian) and vitamin shop.

Noise measurements were conducted at the edge of the Village Center parking lot, located between the proposed project's Building 7 and the end tenant space (future sushi bar/restaurant that is under construction) in the commercial strip center building paralleling Bake Parkway, for 24 hours shown in Table 10. Table 10 demonstrates the lack of any apparent significant commercial activity noise generation. Bake Parkway traffic is the dominant contributor to the overall noise exposure. Thresholds were exceeded, usually by only a few decibels, several times during the day. A peak noise event from 7-8 a.m. was apparently localized contamination associated with a construction activity or vehicular movement in the parking lot directly next to the meter. Individual noise spikes, mostly between 8 a.m. and 1 p.m., were in excess of standards likely due to construction activity or parking lot vehicle activity close to the meter.

From the noise meter location, the proposed residences will have a minimum setback of 25 feet. This setback distance would be expected to attenuate noise levels by 10 dB. With this degree of attenuation, all occurrences of the noise standard being exceeded in Table 10 would fall below the noise standard at outdoor spaces (balconies) on the second story of Buildings 7 and 8, with the exception of the Lmax of 94 dB recorded from 7-8 a.m. As noted above, this spike was due to an unusual activity near the noise meter and is not typical or common for the area. This is evidenced by the lack of other spikes of the same magnitude over the 24-hour period. Interior noise levels would be attenuated by an additional 30 dB, which brings these noise levels well below standard. As such, there is no probable noise constraint created by the proposed project for a continuation of the types of uses currently occupying the center, and no noise impact mitigation is required.

In addition to typical restaurant, retail and personal service activities at the stores in the strip center, other commercial activities include loading/unloading supplies and food at the front of the strip center. Loading and unloading activities are the noisiest common occurrence at the strip center; however, only the loading and unloading activities at the stores paralleling Bake

Parkway, closest to the project site would be discernable at the project boundary. A new sushi bar/restaurant and the new Cinnamon Productions restaurant are currently under construction.

Restaurant deliveries are made with 2-axle trucks and off-loaded with hydraulic lift gates and then hand carried or wheeled to the restaurants with dollies. Measured noise levels at commercial uses with light truck deliveries are typically less than 70 dB Lmax at 50 feet. This is less than the City of Lake Forest daytime standard and Building 7 will be more than 50 feet from the nearest loading area for any of the restaurants. The nail salon, dental group and acupuncturist, among others, do not have truck deliveries or unloading activities. The intensity of current commercial uses is such that residential proximity will not create a noise constraint upon such uses.

Table 10
On-Site Noise Impacts from Village Center (dB)

Time Interval	Lmax	5 minute max	15 minute max	30 minute max
14:00-15:00	67	57	54	53
15:00-16:00	66	58	57	56
16:00-17:00	65	58	55	54
17:00-18:00	69	56	54	53
18:00-19:00	71	55	54	53
19:00-20:00	62	55	53	53
20:00-21:00	63	57	54	53
21:00-22:00	58	54	52	52
22:00-23:00	63	52	46	46
23:00-24:00	57	46	45	44
0:00-1:00	61	46	44	43
1:00-2:00	53	45	43	42
2:00-3:00	56	44	42	41
3:00-4:00	54	45	43	41
4:00-5:00	58	52	45	45
5:00-6:00	67	57	53	52
6:00-7:00	65	56	53	53
7:00-8:00	94^a	73^a	65^a	62^a
8:00-9:00	82	66	57	55
9:00-10:00	79	62	57	54
10:00-11:00	76	58	54	53
11:00-12:00	72	58	54	53
12:00-13:00	76	61	55	54
13:00-14:00	74	59	54	53
Not To Exceed Daytime Standard	75	65	60	55
Not To Exceed Nocturnal Standard	70	60	55	50

^a Localized contamination resulting from construction activity in the future sushi restaurant tenant space or other uncommon activity (e.g., excessively loud motorcycle or car) .

Notes: Shaded boxes indicate hours subject to nocturnal noise standards.

Figures in **bold** exceed standards.

NOISE IMPACT MITIGATION

As described above, short-term construction noise intrusion and vibration impacts are judged to be less-than-significant with implementation of standard conditions on construction permits requiring compliance with the City of Lake Forest Noise Ordinance. The allowed hours of construction are 7 a.m. and 8 p.m. on weekdays and Saturdays. Construction is not permitted on any national holiday or on any Sunday. These hours are included as conditions on any project construction permits and these limits will serve to minimize any adverse construction noise impact potential. No mitigation measures are required to reduce impacts from construction-period noise or vibration. This conclusion would continue to apply should the proposed conversion of the vacant car dealership to the east and southeast of the project site to residential use proceed.

During operations, traffic noise from Bake and Portola Parkways may exceed City standards for outdoor recreational deck space for Plan 6 units along the site perimeter adjacent to these roadways, as shown on Figure 7 and 8. As noted in General Plan Safety and Noise Element Table SN-2, Note 4, these standards only apply to decks with a depth of 6 feet or greater, so only the larger decks along these roadways would exceed standards. Traffic noise on these decks may marginally exceed the threshold by 1 dB.

As shown in Figures 2 and 4, the Town Centre Residential project provides indoor and outdoor recreation space in a central location. The City may consider this common outdoor space, which is shielded by buildings from roadway noise and is therefore below the 65 dB CNEL threshold, to adequately provide outdoor open space for residents without the need for noise-protected decks. Most jurisdictions do not require noise protection for individual recreational space if noise-protected common space is provided, which is the case with this project. Should the City of Lake Forest make this same determination for the Town Centre Residential project, no mitigation for roadway noise at Plan 6 decks would be required.

If, however, the City deems it necessary to reduce noise levels at all decks to the 65 dB CNEL threshold, the following mitigation measure must be implemented:

- Plan 6 decks facing Portola or Bake Parkways, where noise levels have been identified in this Noise Impact Analysis to exceed 65 dB CNEL, must include a transparent glass or plastic shield, or other similar noise-reducing barrier which would reduce noise levels to a maximum of 65 dB CNEL. Shields must be 5.5 feet tall and fill the entire roadway frontage of the deck. This mitigation measure only applies to decks with a depth of 6 feet or greater. At the option of the builder, a future noise analysis may be conducted and submitted to the City of Lake Forest Building Official for review to show that the actual noise level at each of these decks does not exceed the 65 dB CNEL standard. If confirmed by the Building Official that noise levels are satisfied, placement of a noise barrier is not required.

Residential habitable rooms facing Portola Parkway and Bake Parkway will meet the City of Lake Forest 45 dB CNEL interior noise standard with no acoustical mitigation required. It is

noted that rooms where window closure is required to meet noise standards must be provided with supplemental ventilation, which is a standard procedure required in the California Building Code.

The project noise impact study indicates a less-than-significant noise impact from project-related traffic on project vicinity receptors. Project-related traffic will not cause noise standards to be exceeded, nor make substantially worse any existing violations.